

true order of events. The haustoria have been formed by the hyphæ, and figures are given showing every stage in their development. The first haustorium may be formed by the infecting tube immediately after its penetration through the stoma, and figures are given showing the remains of the germ-tube outside a stoma, the swelling of its tip over the stoma into an appressorium, the passage through the stomatal cavity, and its development into a vesicular swelling whence the true infection tube arises, which latter may at once put forth a haustorium. In some cases all these latter phenomena are visible in one and the same preparation.

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“The Œstrous Cycle and the Formation of the Corpus Luteum in the Sheep.” By FRANCIS H. A. MARSHALL, B.A. Communicated by Professor J. C. EWART, F.R.S. Received February 17,—Read March 12, 1903.

(Abstract.)

*Introduction.*—A preliminary account of this investigation was communicated to the Royal Society in 1901, and published in the PROCEEDINGS for that year. Subsequently the work has been carried further, and recently brought to a conclusion.

*The Œstrous Cycle.*—In Scotch black-faced sheep the length of the sexual season is shown to vary with the locality, both in regard to the number of diœstrous cycles in a season, and to the duration of each cycle. It is shown further that there is a perfect gradation between the monœstrous condition of some wild sheep to the extreme polyœstrum of certain Merinos.

*Superficial Phenomena of Proœstrum and Œstrus.*—The proœstrum is marked by a mucous or sanguineo-mucous flow. It is very rapidly succeeded by œstrus (the period of desire), the two periods frequently seeming to occur simultaneously, but this is because of the abbreviation of the process.

*The Histology of the Uterus during the Diœstrous Cycle.*—The changes through which the sheep's uterus passes during a single diœstrous cycle can be divided into four groups or periods, as follows:—(1) Period of rest; (2) Period of growth and increase of vessels; (3) Period of breaking down of vessels and extravasation of blood; (4) Period of recuperation and pigment formation. Bleeding into the uterine cavity and at the external genital aperture does not always

occur. The extravasated blood retained in the mucosa forms pigment, the change being effected by the agency of leucocytes, as supposed by Bonnet, but not by Kazzander. But the extravasation occurs in the superficial part of the mucosa. Miniature lacunæ are sometimes formed after extravasation. The severity of the proœstrous process tends to diminish with each successive diœstrous cycle in a season. There is never any removal of stroma and not necessarily of epithelium.

The facts recorded render the homology between the diœstrous cycle in the sheep and the menstrual cycle of the Primates very probable, while further statements regarding the author's researches on the ferret, with which the proœstrum in regard to severity is intermediate between that of the sheep and menstruation in monkeys, afford additional evidence of the identity of the two processes.

*Ovulation, with Notes on the Atretic Follicle and the Causes of Barrenness.*—Ovulation can occur spontaneously at any œstrous (or proœstrous) period with Scotch black-faced sheep, excepting at certain œstri outside the regular sexual season, when the additional stimulation supplied by coition may be necessary. In the ferret, ovulation does not occur in the absence of coition, without which the follicles undergo atresia. In the sheep, atresia is commonest in follicles of about one-eighth to one-half the dimensions of the mature follicles. When it occurs with any considerable frequency, it must affect the barrenness percentage in subsequent breeding seasons. The atretic follicle differs from the developing corpus luteum in the absence of any discharge to the exterior, the membrana granulosa degenerating and disappearing prior to any considerable ingrowth from the connective tissue wall.

*The Formation of the Corpus Luteum.*—The lutein cells are derived from the membrana granulosa, while the connective tissue element is supplied by the proliferation and ingrowth of the thecæ interna and externa, as described in the preliminary communication. Leucocytes are abundant, especially at the sixteen-hour stage of development, but these disappear in later stages without giving rise to connective tissue as described by Sobotta. The cavity of the discharged follicle is filled in by the further ingrowth of connective tissue.

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